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The UK is well known for producing safe, quality milk which goes into making products that support a healthy diet in our population. However, in the UK, and around the world, milk production is set back by the occurrence of bovine mastitis, an endemic disease representing not only a financial and emotional burden for farmers (Kolstrup and Hultgren, 2011; Jansen, 2010; McLeod, 2008), but a welfare problem for dairy cows (von Keyserlingk and others, 2009). Despite years of research and information about the risk factors and management strategies related to mastitis incidence and prevalence, there is still substantial room for improvement and numerous opportunities to increase the implementation of changes to farm management that could improve the mastitis situation considerably.

Although still omnipresent, improvement in mastitis parameters has been made over the years. Farms vary hugely, however, with clinical mastitis rates still exceeding 100 cases per 100 cows per year on almost 25% of farms (Bradley and others, 2007). Whilst overall levels of clinical and subclinical mastitis have arguably improved, many farms are still experiencing excessively high levels of this disease.

As the paper by Down and colleagues indicates, the evidence supporting certain management changes that may serve to decrease mastitis rates is often well established. Much of this risk factor literature has been distilled and packaged into the AHDB Dairy Mastitis Control Plan (DMCP), which is well described in this paper and others (Bradley and others, 2007; Green and others, 2007). Trained plan deliverers can use the DMCP to assist them in advising farmers on strategies to reduce mastitis incidence and prevalence. This role - inhabited mainly by veterinarians - places these advisors at the forefront of knowledge dissemination (FAWC, 2011). The literature suggests, however, that whilst veterinarians recognise their influence and the need to be proactive advisors, acting upon this awareness can still be challenging (Jansen, 2010).

Whilst the approach of the DMCP is a good one – farms show a mean decrease of 22% in the proportion of the herd with clinical mastitis when implementing the plan – compliance with recommendations is critical to its efficacy (Green and others, 2007). Down and colleagues have indicated that compliance is variable, with recommendations known to help prevent mastitis often not practiced on dairy farms, even when prioritised by a plan deliverer. Anecdotally, this variable compliance has been attributed to aspects of the advisory process, where communication at the point of delivery may have failed to engage farmers in the plan recommendations.

An enhanced awareness of what is likely to motivate farmer behaviour change - in addition to evidence-based communication approaches that support this process - is therefore essential to help drive the dairy industry towards further improvement. Exploring why mastitis persists on farms, in light of recent research on the practical and psychological components of implementing behaviour change, is therefore critical to promote the uptake of advice and reduce the incidence of mastitis on farms in the UK.

Down and colleagues identify a number of areas where farms could improve their implementation of important mastitis prevention practices. For instance, grazing paddocks for two weeks and then resting for four weeks is not technically difficult, but is still not in place on a number of dairy farms. It is easy to measure the area used for bedding, and, again, achieving a clean environment (adding fresh bedding daily, scraping areas where cows congregate) is something farms usually have the equipment they need to attain, but many still miss the mark. Changing liners and foremilk cows usually are quite possible, but still often neglected.

Practical constraints on time, labour, finance and farm facilities have previously been reported by farmers as barriers to disease control (Leach and others, 2010). The effect of these constraints on behaviour is not straightforward, however; when farmers rated the importance of these barriers

upon their acting to control disease, their responses varied considerably (Leach and others, 2010). Also, the factors most often cited as inhibiting behaviour change (knowledge, time, labour, cost) are not rated as 'extremely important' barriers by the majority of farmers (Leach and others, 2010). As such, it is critical to be aware that no single factor can be generalised as limiting all farmers.

Farmer awareness has also been cited as an issue in disease management. With mastitis, however, awareness is certainly at the forefront of dairy production; farmers are often financially rewarded for low and penalised for high somatic cell count (SCC), as it reflects milk quality (Biggs, 2009). As such, many farmers monitor cows closely for signs of mastitis and record SCC regularly. This illustrates that whilst awareness may be essential to instigate motivation, in itself and, indeed, even when combined with associated financial compensation, awareness alone is often insufficient to evoke change.

Lack of knowledge might also be inhibiting progress towards mastitis management on farm. Research suggests, however, that even farmers described as 'hard to reach' by advising veterinarians feel they have sufficient knowledge to deal with mastitis, and can easily access udder health information when needed (Jansen and others, 2010).

Another factor may be normalisation - because mastitis occurs in all herds, its presence often becomes normalised, both in farmer attitudes and in subjective norms. The fact that mastitis is multifactorial and has no one simple solution serves to reduce farmer perception of efficacy in disease management and increases farmer ambivalence over control measures. Down and colleagues detail the number of interventions prioritised by DMCP plan deliverers as *'ranging from 1-92, with a median of 22'*. This means that plan deliverers are leaving farmers with a number of suggestions of areas for change, which may be difficult for them to digest or may overwhelm them with too many suggestions to choose from.

It is therefore clear that the persistence of mastitis on dairy farms is complex and cannot readily be attributed to any one practical consideration, nor generalised across farmers. To improve the uptake of advice, therefore, we need to further understand the complexities of farmer decision making, and find new and innovative ways to engage farmers in the process of change.

Down and colleagues point out that many of the factors that may be implicit in the high levels of mastitis on dairy farms should already be known, but are not being implemented. And it may be assumed that farmer decision making is not always clear and understandable. For example, farmers may self-report that they already have sufficient knowledge about mastitis risk factors, management and cost, although they still fail to translate this knowledge into remedial action. Exploring this phenomenon more fully by accounting for the 'human factor' implicit in farmer behaviour can offer a more nuanced understanding, focussing instead on the wider context of the factors contributing to farmer behaviour and the potential for change.

There has already been a paradigm shift of this nature within interventions aimed at improving the uptake of advice. An increased recognition of both farmer attitudes and autonomy in herd health processes has underpinned a move from knowledge transfer to knowledge exchange. In the former, having the veterinarian providing information was generally perceived as sufficient to influence behaviour, whilst the latter involves the veterinarian actively engaging farmers – in possession of their own knowledge and experience - in the advisory process. This change in the nature of discourse between veterinarians and clients has already been recognised as a process important to the future of the veterinary profession (VetFutures, 2015), which states that *'by working in partnership with clients, vets are better positioned to convince them of the value of preventive services'* (in this case, mastitis management strategies). This shift will also be important for veterinarians as they seek to

promote uptake of advice which would improve cattle welfare by ethically influencing farmers, a point which has also been recognised by the British Veterinary Association (BVA Animal Welfare Strategy, 2016).

The communication of veterinarians and dairy farmers around the area of mastitis specifically has been investigated by Jansen (2010), who suggests that tackling many barriers to the uptake of advice on farms could be achieved by veterinarians '*applying elementary communication techniques to their (veterinary) advice*'. We propose that the veterinary profession needs a communication approach to fully engage farmers and to stimulate behaviour change in order to encourage the implementation of mastitis management factors on farms. One option would be Motivational Interviewing (MI), a communication methodology from the medical sciences. Our ongoing work in this area leads us to hypothesise that the application of MI techniques will fill a well-recognised gap in the need for improvement of communication between veterinarians and farmers, and should lead to better adoption of advice on animal health and welfare, specifically in mastitis.

We are currently examining existing veterinarian-farmer communication strategies to inform the development of an MI training package targeted specifically at livestock veterinarians. Our data suggest that current veterinary communication practices do not employ MI methods overall. However, some MI skill naturally occurs in practicing cattle veterinarians, indicating the feasibility of this methodology's utilisation within this context. The training package under development will subsequently be employed in a controlled trial, investigating whether MI-consistent communication improves the adoption of veterinary recommendations. We believe that further training in MI methodology could enhance the advisory process for both veterinarians and farmers, thereby improving the uptake of advice and reducing the incidence of mastitis - amongst other management challenges - on UK dairy farms. Use of MI within the veterinary community could also become widespread at a relatively low cost, to be used at will within established interventions or in routine, everyday discourse on farm to aid in promoting widespread behaviour change.

The descriptive study of implementations used in mastitis management on UK dairy farms by Down and colleagues illustrates that there is still room for improvement. Much more work, specifically in the area of advisor-farmer communication, must be done if we are to achieve the stringent targets set forth by the creators of the DMCP.

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